

# **Montgomery County, Maryland**

## **The GIS Intranet Server**

Program Category #14: Information Technology

### **1.0 Abstract**

The Montgomery County Department of Information Systems and Telecommunications - Geographic Information Systems (DIST-GIS) team has developed a GIS-based Intranet for sharing geo-spatial information, serving on-line maps, and accessing metadata. The GIS Intranet Web site was developed to provide information and tools necessary to satisfy the general geo-spatial needs and mapping requests of Montgomery County government departments and agencies. Intranet mapping and metadata applications are currently served from the Intranet Web site and are maintained on a Windows NT 4.0 Server, which is accessible to County departments through the GIS local area network (LAN). Web visitors need only use their Netscape 4+ or Internet Explorer 4+ web browsers to display, search, browse, query, and print map features, geo-spatial information/events, and metadata. Eventually, lessons learned with the GIS Intranet will be applied to an Internet-based web site, which will enable Montgomery County citizens to enjoy the same services.

### **2.0 Need for the Program**

The Montgomery County DIST-GIS Intranet Web site, map servers, and on-line metadata application were developed to provide County departments and agencies (customers) with access to frequently requested geo-spatial data sets, maps and information. Consequently, the GIS Intranet empowers government personnel by providing access to easy-to-use on-line mapping and metadata tools as well as accurate geo-spatial data and information. County personnel with access to the Intranet can use a Netscape 4+ or a Internet Explorer 4+ web browser to display or query ArcInfo, ArcView, or Oracle/Spatial Data Engine (SDE) data layers and associated metadata stored on the Montgomery County GIS data servers. With just a click of a mouse, a County staff member connected to the GIS LAN can use their web browser to generate a map or to download a data set, which until recently, would have taken hours or even days to complete! If the information or data is unavailable, hyperlinks to other GIS-related Montgomery County local government web sites are provided.

As County government departments and agencies struggle to keep pace with increasing demands for GIS services, the DIST-GIS Intranet web site provides an effective low-cost alternative solution for sharing geo-spatial knowledge and data, improving inter-agency linkages, avoiding costly duplication, and enhancing data quality through metadata. The site also "markets" the services and capabilities of DIST-GIS throughout the Montgomery County government. The Intranet also provides an effective "proving ground" for testing Web sites prior to Internet deployment.

### **3.0 Description of the Program**

The DIST-GIS Intranet Server is comprised of the DIST-GIS Web site, an on-line metadata application, several map servers, and a map gallery.

### ***DIST- GIS Web Site***

The Montgomery County DIST-GIS Intranet Web site was developed during the winter of 1999 and 2000 using Microsoft FrontPage 2000. The web site resides on a Window NT 4.0 Pentium II Server with 256K RAM and 8.4 gigabyte hard drive running Microsoft Internet Information Server 4.0 (Service Pack 5). The theme of the web site was designed in concert with the Montgomery Government Internet web site home page (<http://www.co.mo.md.us>). The DIST-GIS Intranet home page contains links to map servers, including the Map Room on the Net, map galleries, publications, events, and staff. Related Montgomery County GIS hyper-links can also be accessed through the home page as well (Figure 1).



**Figure 1: DIST-GIS Intranet Home Page**

The Web site provides a forum for linking County web visitors to on-line maps, map image galleries, and metadata as well as providing the latest in local GIS news and events. And if web visitors should have any questions concerning GIS or the Web site, a Comment Form, written using Microsoft's Active Server Page (ASP) technology, is provided to enable web visitors to ask questions or provide suggestions to DIST-GIS staff regarding GIS in Montgomery County. The suggestions or comments are recorded and stored in a Microsoft Access database located on the NT Web Server. A search engine is also provided to search DIST-GIS Intranet web pages.

### ***On-line Metadata Application***

The Montgomery County On-line Metadata application was developed using Microsoft's Active Server Page (ASP) technology and integrated into the Intranet web site using FrontPage 2000. Metadata is a crucial component of any GIS because it ensures data quality.

The ASP Metadata web pages, developed using a combination of HTML and VBScript, allow DIST-GIS staff to add, edit, display, and search geo-spatial metadata for GIS data sets, map compositions, graphic files, etc... The metadata stored in the DIST-GIS database archive satisfies the mandatory or minimum geo-spatial metadata requirements stated in the 1998 Federal Geographic Data Committee Content Standard for Geo-spatial Metadata (<http://www.fgdc.gov>).

The metadata application requires DIST-GIS staff to enter a login name and password prior to adding or editing metadata. Once logged on, a DIST-GIS staff member can then add, edit or search metadata. In order to add metadata, a user need only to click the "Add Metadata" hyperlink and complete a form designed to characterize or describe the data set (Figure 4). Data identification information, descriptions, status, and constraints, time period of content, spatial domain and references, keywords, and contact reference information are stored in a Microsoft Access database record, linked through ODBC, and subsequently archived. On-line help is provided for each metadata field, which assists the users in entering or updating metadata.

**Figure 2: Metadata Form**

The screenshot displays a web-based metadata form with the following sections and fields:

- Identification Information:**
  - Identity: Carol Bernard (Pick from list)
  - Originator: Montgomery County DIST-GIS
  - Publication Date (MM/DD/YYYY):
  - Title:
  - Requesting Dept/Agency:
- Data Description:**
  - Abstract:
  - Purpose:
  - Time Period of Content:
    - Begin Date (MM/DD/YYYY):
    - End Date (MM/DD/YYYY):
    - Currentness Reference: Publication Date
- Data Status/Updates:**
  - Data Status: Complete (Pick from list)
  - Data Update Frequency: As Needed (Pick from list)
- Spatial Domain:**
  - Geographic Area of Study: Montgomery County, Maryland
  - West Bounding Coordinate (-DDD.XXX): 077.5355
  - East Bounding Coordinate (-DDD.XXX): 076.8883
  - North Bounding Coordinate (DD.XXX): 39.3536
  - South Bounding Coordinate (DD.XXX): 38.9202
- Spatial Reference:**
  - Map Projection: Maryland State Plane (NAD83)
  - Map Scale: N/A
  - Map Units: Feet
- Keywords:**
  - Keyword Thesaurus: None
  - Theme Keywords: Agriculture (Pick from list)
- Constraints:**
  - Access Constraints: Non-Public (Pick from list)
  - Data Use Constraints: None
- Data Structure Description:**
  - File Size (bytes):
  - Data Format:
  - Media Type:
  - Software and Version:
  - Data Location:
- Metadata Reference:**
  - Metadata Contact:
  - Address Type: Mailing/Physical Address (Pick from list)
  - Address: 110 N. Washington St., Suite 501
  - City: Rockville
  - State: Maryland
  - Postal Code: 20850-2204
  - Phone: 240-777-2883
  - Email:
- Buttons:** Submit Metadata, Reset Form

A metadata search engine is also provided that enables users to search Montgomery County DIST-GIS metadata by Title (filename), by publication date (a range of dates), and by theme (agriculture, community facilities, demographics, etc.). For example, after a user submits their search criteria, the search engine locates and displays a listing of the metadata records requested. The user may then select the metadata item from the list and display the contents of the metadata record. The contents can then be printed or downloaded. Those users with administrator privileges are granted access to revise the metadata file if necessary. In addition to the search tool, users may browse parsed (HTML) and pre-parsed (text) metadata files by theme and by source. Eventually, it is anticipated that DIST-GIS will publish HTML and text based metadata to the County Internet site.

## Map Servers

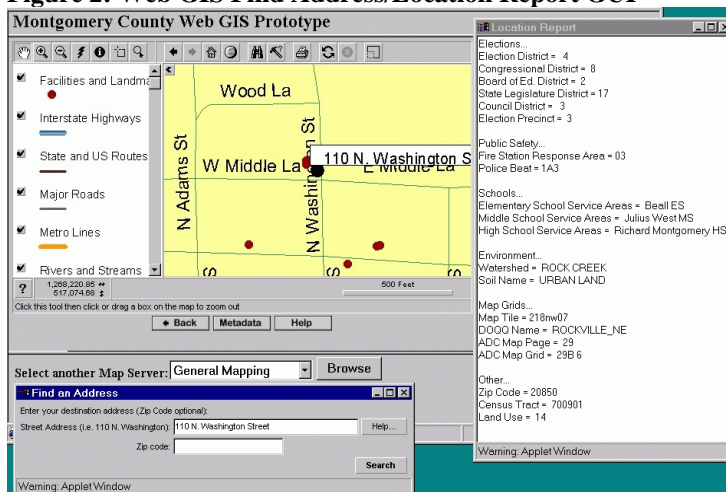
Several map services are available through the DIST-GIS Intranet Web site. The map servers were developed using Environmental Research System Institute's (ESRI's) ArcView Internet

Map Server 1.0a and MapCafe with ArcView GIS (version 3.2). Data used in the map services were developed by various sources (indicated in the metadata) using primarily Workstation ArcInfo 7.2.1 or ArcView. Available map services are described below:

### **Web GIS Map Server**

The Web GIS Map Server Graphic User Interface (GUI) enables users to pan, zoom in, zoom out, identify features, query data layers, select map features, print maps, locate addresses, and produce location reports based on address. The Montgomery County DIST-GIS team maintains a street centerline-based address range database (GBF/DIME) that is used to locate addresses. A Java tool enables users to locate an address anywhere in Montgomery County. A point-in-polygon program is then used to generate a location report providing information about the area immediately surrounding the address (See Figure 2).

**Figure 2: Web GIS Find Address/Location Report GUI**



The program also allows users to select, identify, query, and print map features including public facilities, landmarks, churches, schools, cemeteries, golf courses and other locales within Montgomery County. A Java script program was also provided to enable web visitors to browse or select other map services simultaneously. On-line help and metadata search tools provide users with additional assistance and information.

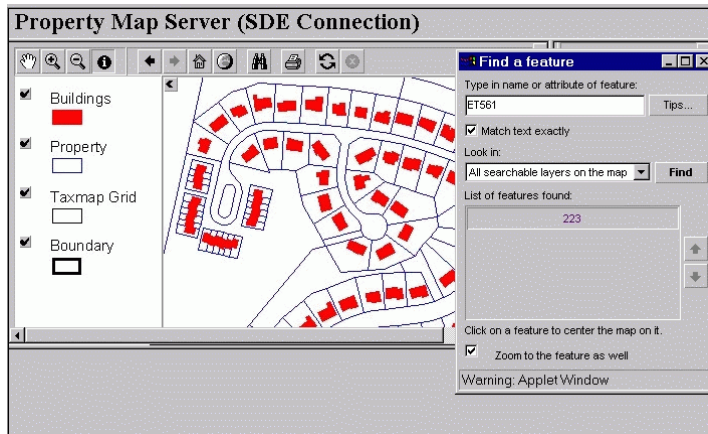
The data provided in the Web GIS Map Server was provided by the United States Geological Survey Geographic Names Information Database (stored on the ESRI Maps and Data CDROM) and the Montgomery County DIST-GIS team.

### **Property Map Server**

The property map server, also developed using ArcView Internet Map Server 1.0a and MapCafe, enables users to identify and select parcels in the Montgomery County property database, which is maintained by Montgomery County Park and Planning Commission. Web visitors need only to use the Find tool, a Java-based program, to locate the property tax map desired. A map illustrating the extents of the selected tax map is then generated complete with property lines and building footprints! The Identify tool can then be used to identify individual parcels. Consequently, a user can find the parcel and display its attributes within

seconds! This map server utilizes ESRI's Spatial Data Engine (SDE) technology and Oracle 8i to quickly display the property lines and building footprints.

**Figure 3: Property Map Server**



### **Map Room on the Net**

The Intranet-based "GIS Map Room on the Net" application was designed to serve a collection of thematic and demographic base maps and department-specific maps to all County departments that are linked to the GIS LAN. Map Room users are able to access maps and information via Netscape 4+ and Internet Explorer 4+ web browsers. The Map Room serves on-line maps representing election boundaries, police and fire districts, snow removal and refuse collection/recycling information as well as general mapping layers.

### ***Map Gallery***

The GIS Map Gallery is currently provided on the Montgomery County Internet and Intranet (<http://www.co.mo.md.us/gismaps/index.htm>). Web visitors can display and download JPEG or GIF image files of map presentations generated by DIST-GIS staff. The images are categorized by the following topics:

- Basemaps
- Community Development and Housing
- Culture and Recreation
- Environment
- Health and Human Services
- Maryland National Capital Park and Planning
- Miscellaneous Images
- Other Executive Branch Departments
- Regional Service Centers
- Public Safety
- Public Works and Transportation

## **4.0 Use of Technology**

The DIST-GIS Intranet Web site was designed and programmed using Microsoft FrontPage 2000 and Java Script. The Web site was published to the County GIS Local Area Network (LAN) using Microsoft's Internet Information Server 4.0 (IIS 4.0) software on a Windows NT 4.0 Server. Graphics developed for the web site and the map gallery were created using Microsoft PowerPoint 97, Corel Draw, ESRI's Workstation ArcInfo 7.2.1, ArcPress and ArcView GIS (Version 3.2). Map servers were generated using ArcView Internet Map Server 1.0a with MapCafe (BuildZ19) and FrontPage 2000. Data depicted in the map services and map gallery were created or maintained using ESRI's Workstation ArcInfo, Spatial Database Engine (SDE)/Oracle 8i, and ArcView GIS software. Active Server Page (ASP) technology, available in IIS 4.0, with VBScript and FrontPage 2000 were used to create the on-line Metadata application and the Comment Form.

## **5.0 The Cost of the Program**

The total cost of the DIST-GIS Intranet Server development including staff time (programming and server maintenance) and software/hardware amounts to \$30,000. Approximately 350 programming hours have been invested into the development of the DIST-GIS Intranet Server so far. The Windows NT 4 Server cost \$7,500, while the GIS and Web publishing software cost \$15,000. Annual Intranet update and server maintenance costs are estimated at \$3,000. Additional equipment costs and staff time for Intranet programming or server maintenance varies in accordance with technological advances as well as the frequency and size of future updates.

On the client-end, a Pentium 200 MHz or better Intel-based personal computer running Windows 95, Windows 98, or Windows NT 4 with a Netscape 4 + or Internet Explorer 4+ web browser is recommended with a network interface card to "communicate" with the GIS local area network (LAN). Although, the computer may cost \$1,000.00, the Web browser software is free. An inkjet printer, costing approximately \$200.00, can be used to generate maps.

## **6.0 The Results/Success of the Program**

The effectiveness of the DIST-GIS site is quantified by using advanced Intranet server software technology. Consequently, DIST-GIS staff can actually count the number of hits to the Web site, determine the origin of the client browser, and identify the time of the client/server transaction. As a result, the DIST-GIS team monitors the frequency and time of transactions, as well as the client source. In addition, the Comment Form, designed for users to input GIS questions or comments about the DIST-GIS Web site, enables DIST-GIS staff to monitor and measure the success or results of a web page or map server. Staff Email addresses also provides a quantification mechanism for web visitors to comment. At the end of each week, a report is generated which summarizes the results of Intranet server transactions.

After viewing the Intranet site, other departments have requested DIST-GIS staff to develop additional Map Server applications. For instance, the Montgomery County Division of Traffic and Parking Services (Office of Parking Management) asked DIST-GIS staff to develop a prototype Parking Map Server to enable County government personnel to facilitate parking management efforts in the four major Parking Districts. Work in the prototype Parking Map Server is in progress. Another request is to develop a map server application for the Permit Services Department to enable users to query parcel data, determine permits required, and inquire about the status of permit applications. Moreover, an application for the County's capital improvement program (CIP) is proposed which would enable the Office of Management and Budget (OMB) to display, query, and print CIP location maps and associated attribute data.

## **7.0 Worthiness of an Award**

The DIST-GIS Intranet Web site integrates advanced web publishing and map server technology with a network of GIS data servers and relational databases to sustain a virtual geo-forum that provides the information and tools necessary to satisfy the general geo-spatial needs and mapping requests of Montgomery County government departments and agencies. The delivery of free map services, information, and tools empowers County government departments and agencies by enabling them to create their own maps using a web browser. Therefore, County government investments into GIS software and training may be minimized. In addition, as the Intranet begins to satisfy the majority of the County mapping requests, DIST-GIS staff can focus more on updating and maintaining data and developing applications.

Inevitably, the DIST-GIS Intranet Web site will be published to County's Internet Web site, which will enable County citizens connected to the Internet an opportunity to empower themselves to discover more about the communities in which they live. In addition, the Web site could be used as a model for other counties.